

Attorney Docket No. 9792909-5787

PATENT

IN THE CLAIMS:

1. (Currently amended) A method of manufacturing a semiconductor apparatus comprising:

forming a first mask material film made of organic insulation film on a film to be processed;

forming a tapered aperture pattern, in which a bottom of said aperture pattern is made narrower than an open side of said aperture pattern, on said first mask material film; and

forming a vertical aperture pattern in said film to be processed by etching said film to be processed using said first mask material film as a mask;

wherein the bottom of the tapered aperture pattern is formed at a desirable micro dimension exceeding capabilities of lithography techniques.

2. (Previously presented) The method of manufacturing a semiconductor apparatus according to claim 1 further including removing said first mask material film.

3. (Previously presented) The method of manufacturing a semiconductor apparatus according to claim 1 wherein said film to be processed has a step.

4. (Previously presented) The method of manufacturing a semiconductor apparatus according to claim 1 wherein said first mask material film is made of material having a low dielectric constant.

5. (Canceled)

6. (Currently amended) A method of manufacturing a semiconductor apparatus comprising:

providing a film to be processed on a substrate;

providing at least one dielectric mask material film on said film to be processed, the dielectric mask material having a dielectric constant lower than silicon dioxide and a heatproof temperature of about 350 degrees Centigrade;

providing a resist film on the at least one dielectric mask material film, ~~said dielectric mask material film being disposed on said film;~~

forming an aperture pattern on said resist film;

using said resist film as a mask and etching said dielectric mask material film to form an open pattern, said open pattern being formed with tapered sides such that a bottom of said open pattern is narrower than an aperture side of said open pattern; and

forming a vertical aperture pattern in said film by etching said film;

wherein the bottom of the open pattern is formed at a desirable micro dimension exceeding capabilities of lithography techniques.

7. (Currently amended) The method of manufacturing a semiconductor apparatus according to claim 1 wherein said forming of the tapered aperture pattern includes setting a temperature of said substrate to between about minus 50 degrees Centigrade to and about 0 degrees Centigrade.

8. (Previously presented) The method of manufacturing a semiconductor apparatus according to claim 1 wherein said first mask material film has a dielectric constant lower than silicon dioxide.

9. (Currently amended) A method of reducing a contact hole diameter in a semiconductor apparatus comprising:

providing a film to be processed on a substrate, the film to be processed having a step;

disposing at least one dielectric mask material film on said film to be processed such that the at least one dielectric mask material film planarizes an unevenness created by said step;

providing a resist film on the dielectric mask material film;

forming an aperture pattern on said resist film;

using said resist film as a mask and etching said dielectric mask material film to form an open pattern, said open pattern being formed with tapered sides such that a bottom of said open pattern is narrower than an aperture side of said open pattern,

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wherein said bottom of said open pattern is formed at a desirable micro dimension exceeding capabilities of lithography techniques; and

vertically etching said film to obtain the contact hole with the reduced diameter.

10. (Previously presented) The method of manufacturing a semiconductor apparatus according to claim 1 further comprising forming a second mask material film on the first mask material film.

11 (Currently Amended) The method of manufacturing a semiconductor apparatus according to claim 10 wherein the first mask material film ~~is made of FLARE or SILK~~ has a heatproof temperature of about 350 degrees Centigrade.

12. (Previously presented) The method of manufacturing a semiconductor apparatus according to claim 10 further comprising forming a resist film on the second mask material film.

13. (Previously presented) The method of manufacturing a semiconductor apparatus according to claim 12 further comprising etching the resist film.

14. (Previously presented) The method of manufacturing a semiconductor apparatus according to claim 13 further comprising etching the second mask material film.

15. (Currently Amended) The method of manufacturing a semiconductor apparatus according to claim 3 wherein forming the first mask material film on the film to be processed planarizes an unevenness created by said step.

16. (Previously presented) The method of manufacturing a semiconductor apparatus according to claim 6 wherein providing the film to be processed on the substrate includes disposing the film to be processed directly on the substrate.